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Claims

[c1] A lateral resistivity sensor disposed in a recess in a tubular having a longitudinal axis and adapted for subsurface disposal, comprising:
an insulating base layer disposed in the recess;
a toroidal antenna disposed over the insulating base layer; and
a shield disposed over the recess and adapted to prevent electric current flow along the shield in a direction parallel to the longitudinal axis of the tubular near the toroidal antenna.

[c2] The lateral resistivity sensor of claim 1, further comprising an insulating filler disposed in a remaining portion of the recess.

[c3] The lateral resistivity sensor of claim 1, further comprising a pressure compensating mechanism disposed adjacent the toroidal antenna.

[c4] The lateral resistivity sensor of claim 1, wherein the toroidal antenna comprises a conductive wire disposed over the insulating base layer.

[c5] The lateral resistivity sensor of claim 1, wherein the toroidal antenna comprises a toroidal core formed from one of a magnetically permeable material wrapped around the insulating base layer or a ferrite material disposed in the recess.

[c6] The lateral resistivity sensor of claim 1, wherein the shield comprises an insulating mechanism to prevent electric current flow along the shield in a direction parallel to the longitudinal axis of the tubular.

[c7] The lateral resistivity sensor of claim 6, wherein the insulating mechanism comprises a circumferential gap filled with an insulating material.

[c8] The lateral resistivity sensor of claim 1, comprising an electrically insulating material disposed between a junction formed between the shield and the tubular.

[c9] The lateral resistivity sensor of claim 1, wherein the tubular is a drill collar.

[c10] A resistivity logging tool, comprising:
a propagation or induction resistivity antenna disposed on an elongated tubular having a longitudinal axis and adapted for subsurface disposal;
a lateral resistivity sensor disposed in a recess in the elongated tubular; and

a shield disposed on the tubular to cover the lateral resistivity sensor and adapted to prevent electric current flow in the shield in a direction parallel to the longitudinal axis of the tubular near the lateral resistivity sensor.

[c11] The resistivity logging tool of claim 10, wherein the lateral resistivity sensor comprises a toroid.

[c12] The resistivity logging tool of claim 10, further comprising an electrode disposed on the tubular, the electrode selected from one of a ring electrode, a button electrode, and a combination thereof.

[c13] The resistivity logging tool of claim 10, wherein the lateral resistivity sensor comprises:
an insulating base layer disposed in the recess in the tubular; and
a toroidal antenna disposed over the insulating base layer.

[c14] The resistivity logging tool of claim 13, wherein the toroidal antenna comprises a conductive wire disposed over the insulating layer.

[c15] The resistivity logging tool of claim 13, wherein the toroidal antenna comprises a toroidal core formed from one of a magnetically permeable material wrapped in the tubular recess or a ferrite material disposed in the re-

cess.

[c16] The resistivity logging tool of claim 10, wherein the lateral resistivity sensor includes a pressure compensating mechanism.

[c17] The resistivity logging tool of claim 10, wherein the shield comprises an insulating mechanism to prevent electric current flow along the shield in a direction parallel to the longitudinal axis of the tubular.

[c18] The resistivity logging tool of claim 17, wherein the insulating mechanism comprises a circumferential gap filled with an insulating material.

[c19] The resistivity logging tool of claim 10, comprising an electrically insulating material disposed between a junction formed between the shield and the tubular.

[c20] The resistivity logging tool of claim 10, wherein a section of the shield positioned over the induction or propagation resistivity antenna comprises at least one slot filled with an insulating material.

[c21] The resistivity logging tool of claim 10, wherein said recess contains both the induction or propagation resistivity antenna and the lateral resistivity sensor.

[c22] The resistivity logging tool of claim 10, wherein the

tubular is a drill collar.

[c23] A resistivity logging tool, comprising:
an elongated conductive first tubular having a central bore and an insulated circumferential opening along its wall to prevent current flow across the opening;
an elongated conductive second tubular having a lateral resistivity sensor mounted thereon;
wherein the second tubular is disposed within the first tubular such that the lateral resistivity sensor is positioned near the insulated circumferential opening in the first tubular; and
wherein a current path is formed between the first and second tubular on either side of the insulated circumferential opening when the second tubular is disposed within the first tubular.

[c24] The resistivity logging tool of claim 23, wherein a conductive junction is formed between the exterior surface of the second tubular and the interior surface of the first tubular on either side of the insulated circumferential opening when the second tubular is disposed within the first tubular.

[c25] The resistivity logging tool of claim 24, wherein the conductive junction is formed by direct contact between the tubulars or by a conductive element disposed between

the tubulars.

[c26] The resistivity logging tool of claim 23, further comprising a non-conductive shield disposed over the insulated circumferential opening on the exterior of the first tubular.

[c27] A method for mounting a lateral resistivity sensor on a section of a tubular having a longitudinal axis and adapted for subsurface disposal, comprising:
creating a recess on an outer wall of the tubular section;
forming a base layer of an insulating material in the recess;
forming a toroidal core by wrapping a magnetically permeable material over the base layer;
winding a conductive wire around the toroidal core to form a toroidal antenna; and
installing a shield assembly over the recess, the assembly adapted to prevent electric current flow in the shield in a direction parallel to the longitudinal tubular axis near the toroidal antenna.

[c28] The method of claim 27, further comprising filling a remaining portion of the recess with an insulating filler.

[c29] The method of claim 27, further comprising adapting the recess with a pressure compensating mechanism.

[c30] The method of claim 27, further comprising placing a bobbin on the base layer before forming the toroidal core, wherein the bobbin has a trough to guide the wrapping of the magnetically permeable material.

[c31] The method of claim 30, further comprising disposing an insulating material over the toroidal core in the trough of the bobbin.

[c32] The method of claim 27, wherein the shield comprises an insulating mechanism to prevent electric current flow along the shield in a direction parallel to the longitudinal axis of the tubular near the toroidal antenna.

[c33] The method of claim 32, wherein the insulating mechanism comprises a circumferential gap filled with an insulating material in the shield.

[c34] The method of claim 27, further comprising disposing an electrically insulating material between a junction formed between the shield and the tubular.

[c35] A method for building a resistivity tool using an elongated tubular having a longitudinal axis and adapted for disposal within a subsurface formation, comprising: disposing a lateral resistivity sensor in a recess in the tubular;

disposing an induction or propagation resistivity antenna on the tubular; and

positioning a shield assembly on the tubular to cover the lateral resistivity sensor and adapted to prevent electric current flow in the shield in a direction parallel to the longitudinal axis of the tubular near the lateral resistivity sensor.

[c36] The method of claim 35, wherein disposing the lateral resistivity sensor comprises:

disposing a base layer of an insulating material in the recess in the tubular; and

assembling a toroidal antenna comprising a toroidal core and a conductive wire wound around the toroidal core, wherein the toroidal core comprises a magnetically permeable material wrapped around the insulating base layer.

[c37] 37.The method of claim 35, further comprising adapting the recess in the tubular with a pressure compensating mechanism.

[c38] The method of claim 35, wherein the shield comprises an insulating mechanism to prevent electric current flow along the shield in a direction parallel to the longitudinal axis of the tubular.

[c39] The method of claim 35, wherein the insulating mechanism comprises a circumferential gap filled with an insulating material in the shield.

[c40] The method of claim 35, further comprising disposing an electrically insulating material between a junction formed between the shield and the tubular.